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1st Thematic Seminar

"Recycling in textile and waste disposal"

Alcoi, 20th Oct. 2016

@Ágora - Plaça Ramón i Cajal, 6

Event organised with the collaboration of

Ajuntament d'Alcoi

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TEXTILE WASTE MANAGEMENT IN PRATO DISTRICT

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Introduction

Prato district waste management

- 250,000 inhabitants
- 170,000 tonnes per year MSW
- 55% MSW sorted collection
- 90% curbside collection system

Prato is one of the largest Italian industrial districts and one of the most important fabric production districts in Europe.

- 35,000 direct employees
- 7,200 companies in the sector
- 17% of Italian textile exports

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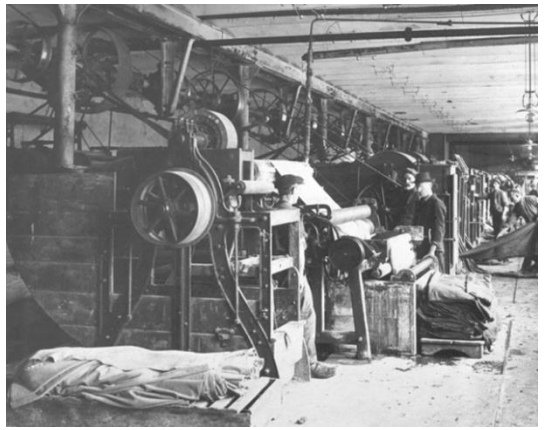
Background

Recycling tradition: recovery and recycling of natural fibers has constituted the basis for the industry of yarns and fabrics
Since 70s it takes place the full expansion of industrial activity from wool-textile district (product oriented) to fashion textile district (market-oriented).
Since 90s a tailoring district, handled mainly by the Chinese community, has settled in Prato industrial area.

In this context the synthetic textile waste has become a new issue to be addressed both from the collection and from the end of life management point of view.



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Textile waste: collection

- Sorted collection of consumer textile waste
- **Industrial textile waste:** textile collection dedicated system is being promoted, trying to involve industrial activities in the proper waste management.
  This can also allows recycling strategies development

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Textile waste: quantity

Industrial waste:
Estimated production: 20,000 t (year 2015)
Collected from public waste management company: 5,000 t

Remaining part: other waste management companies
mixed with MSW
illegal disposal

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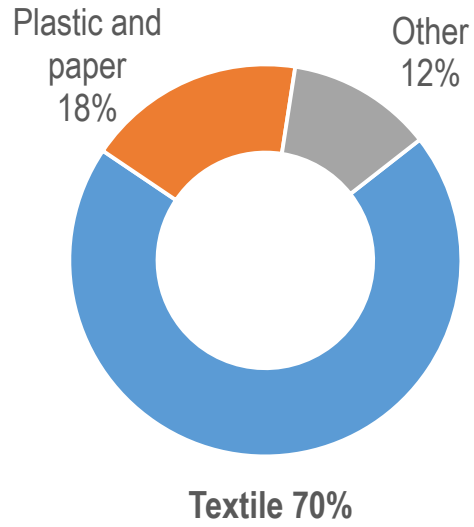
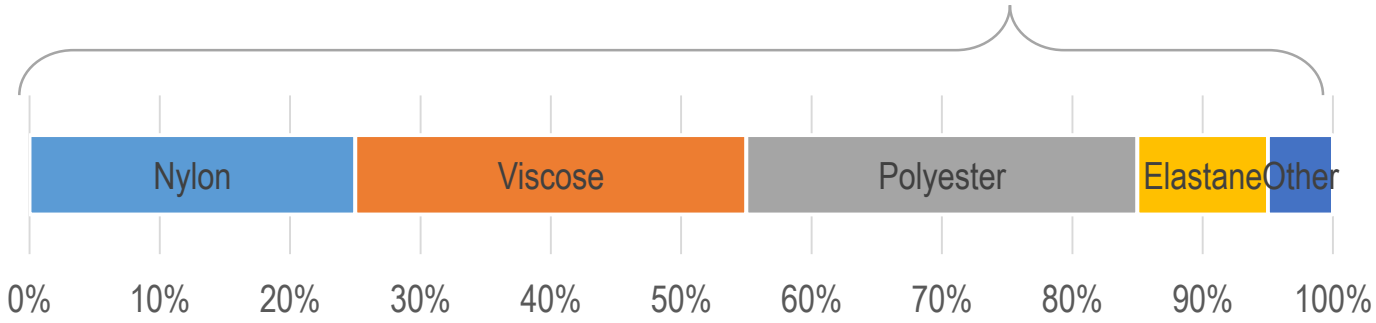
Textile waste: quality

Waste from industrial dedicated collection:
Net calorific value: 22,300 kJ/kg

Large variety of fibers, natural and synthetic – is a limit for recycling

Contamination: plastics and paper used as carrier for garments tailoring;
Chinese habits (food waste or other urban waste can be found in textile scrap containers).





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Textile waste: current management

95% landfill
5% mix with MSW for SRF producton

High landfill disposal costs (about 100 €/t)
Calorific value too high for dedicated waste incineration plants

Waste management company is looking for new technologies that offer a pathway towards the sustainable recycling of synthetic fibre residue from the local garment industry.

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Recycling technologies

Primary approach	recycling a product into its original form	experimentation for plastic polymers recovery
Secondary approach	processing a used product into a new type of product that has a different level of physical and/or chemical properties	experimentation for the production insulating materials for eco-building
Tertiary approach	processes, such as pyrolysis and hydrolysis, which convert the waste into basic chemicals or fuels	Future experimentation for syngas / char / tar production in pyrolytic systems
Quaternary approach	recycling refers to waste-to-energy conversion through incineration	experimentation for the replacement of fossil fuels in cement plant

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Recycling technologies: primary approach

Polymeric separation

Patented system. A non-invasive process allows to separate the thermoplastic fibers from the natural ones using particular patented fluids, heat and pressure

- thermoplastic materials are recovered and transformed directly into 100% pure powders or granules, which can in turn be reused in industrial processes of plastic molding
- natural and artificial fibers, still in the form of the original fabric, can be opened and reused in the production of nonwovens.

A pilot plant is under construction and its results will influence further decisions on waste management.

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Recycling technologies: secondary approach

Production of building insulation panels

Cooperation with a local company. Heat-insulating and sound-absorbing panel from recycled textile fibers.

proximity between textile wastes production and panel production

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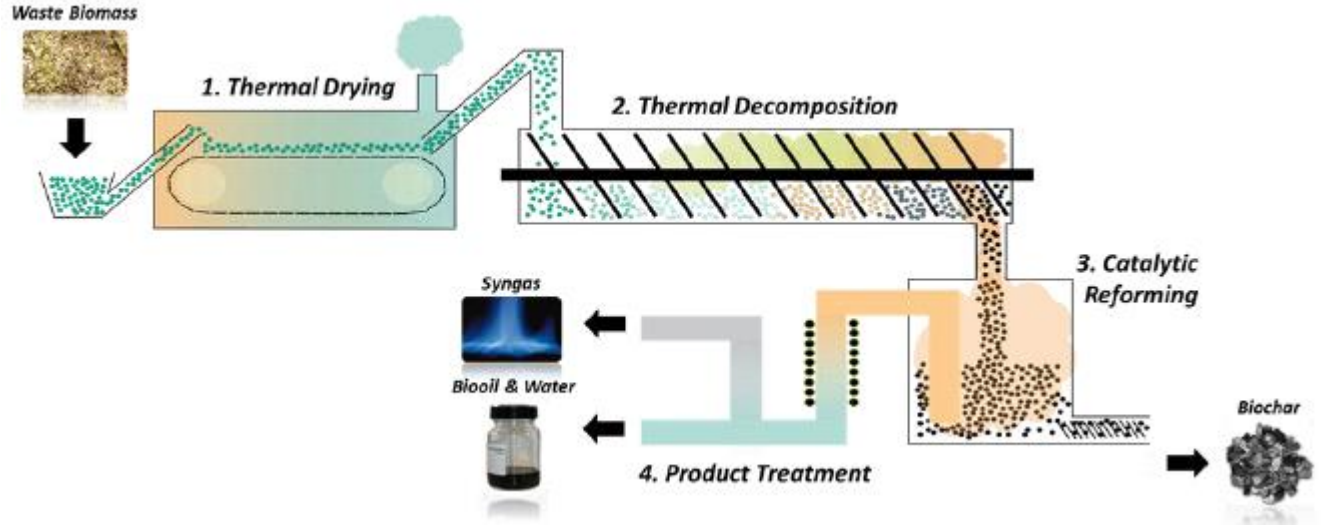
Recycling technologies: tertiary approach

Fuel production
Thermo-Catalytic Reforming TCR® - is able to process most types of organic waste and biomass residue.
The polymers used for the production of synthetic fibre are generally suitable feedstock for the Bio-Activated Cracking (BAC) process which is an optional extension of the pyrolysis process.



In order to evaluate the industrial implementation of the process, Fraunhofer UMSICHT research institute and Susteen Technologies GmbH, recommend to conduct a pre-study focusing on the following questions:

- Test the processing of synthetic textiles on modified lab equipment
- Determine mass & energy balances
- Conduct techno-economic and environmental project evaluation

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Recycling technologies: quaternary approach

SRF Production

Solid Recovered Fuels (SRF) for non-dedicated facilities, such as cement plants or power plant, in substitution of coal.

- high NCV, up to 22.3 MJ/kg (a.r.)
- refining treatment: particle size is the most limit for textile SRF production, as the waste is highly resistant to the shredding mechanical action.

Refining treatment tests using “textile cutting machines”

- low production per hour
- Selective sorting needed (no metals) to avoid blades damages

Mixing with MSW: through waste mechanical treatment plant (current activity).

- lower SRF quality (moisture content, NCV)

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Results and discussion

Experimentation at early stage: lack of data for LCA analysis
Environmental input-output process balance per kilogram of product

		Polymeric separation	Building insulation panels	SRF
Energy demand	MJ*kg-1	1.17	9.81	0.16
Water demand	m3*kg-1	3.20	-	-
Chemical demand	kg*kg-1	0.11	-	-
Residual Waste	kg*kg-1	0.33	0.25	0.11

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Conclusions

Waste disposal requires constant creation of new landfill spaces, which is in contradiction to the environmental goals, including ecosystem protection.
Today this material is disposed through landfill (limited availability, costs are rising).
Co-processing strategy opportunity – cement producer request

Today it is possible to avoid landfill but…
Efforts in separated fibre collection needed, to provide more options for material recycling.
Looking for new technologies for sustainable recycling:

- Production of insulation materials for construction industry:
  the housing crisis together with the limited knowledge of builders did not yet allow a stable production.
- Polymeric separation processes: still waiting for the first industrial prototype.
- Energy recovery option: Strict specifications in terms of size and moist content are required.

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Conclusions

Preliminary considerations on direct environmental performances: energy and water requirements are substantial, in addition a considerable effort in manual pre-sorting operations, which should be influential during the economic feasibility assessments.

Further experiments will provide data for the next life cycle assessment studies and economic evaluations.

Expected results:
High environmental performance due to material and energy recovery and avoided landfill

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